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The impact of disabilities on quality of life in people with multiple sclerosis

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Objective People with Multiple Sclerosis (MS) experience lower levels of quality of life (QOL) than people from the general population. We examined the relative impact of MS-related disabilities on QOL.
Method Data were obtained from a sample of 530 patients who completed the Multiple Sclerosis Impact Profile (MSIP), a disability measure based on the International Classification of Functioning, Disabilities and Health (ICF) and two generic health-related QOL measures, the Medical Outcome study Short Form Questionnaire (SF-36) and the World Health Organization Quality Of Life-BREF (WHOQOL-BREF). The impact of disabilities on QOL was estimated using hierarchical multiple regression analyses after controlling for the clinical course of MS.
Results Disabilities contributed to a unique and substantial extent to QOL variance. "Impairments in mental functions" was the most important QOL predictor. "Fatigue" showed the highest prevalence and severity scores, while the impact on QOL was limited. The estimated impact on QOL appeared to be dependent on the applied QOL measure: the WHOQOL-BREF was sensitive to disabilities related to all four ICF components, while the SF-36 was only sensitive to disabilities belonging to the 'body functions' and 'activities' components.
Conclusion Treatment programmes should target impairments in cognitive functioning, emotional functioning and sleep. Interventions are best evaluated using the WHOQOL-BREF. *Multiple Sclerosis* 2008; **14:** 972–980. http://msj.sagepub.com

Key words: disability; international classification of functioning; disabilities and health; multiple sclerosis; Multiple Sclerosis Impact Profile; quality of life

Introduction

Multiple sclerosis (MS) is a chronic, demyelinating, neurodegenerative disorder of the central nervous system (CNS). Its onset is usually in early adulthood and the course of disease is often progressive and debilitating [1]. Common symptoms include optic nerve dysfunction (e.g., visual failure), sensory disturbance (such as facial pain, sensory level disturbance, numbness, or tingling sensations), pyramidal tract dysfunction (such as increased muscle tone and hyperreflexia), ataxia (such as failure of muscle control in limbs resulting in lack of balance and co-ordination or disturbance of gait), double vision, bladder and/or bowel dysfunction, and sexual dysfunction [1]. In addition, fatigue, cognitive impairment, and depression are often indicated as relevant co-occurring symptoms in MS.

People with MS experience lower quality of life (QoL) levels than people from the general population in health-related QoL domains [2,3]. MS-related disabilities are a likely explanation for this poorer QoL. This has been reported for a number of disabilities, such as fatigue [4–6], cognitive and emotional functioning [7], depression [4,5,8,9], chronic pain [10], and bladder and sexual dysfunction [11].

Although these studies generated clinically important information, they are limited in that

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each study focused on the influence of only one or two disabilities on QoL (univariate analysis). No evidence is available on the relative impact of a number of MS-related disabilities on QoL (multivariate analysis). This evidence could help to understand the impact of MS, and not only of a specific disability, on QoL, which could in turn assist when setting priorities in treatment programs focusing on improvement of QoL with MS. Therefore, the aim of this study is to examine the relative contribution of all known MS-related disabilities on QoL. We have used the international classification of functioning, disabilities and health (ICF) definition for disabilities: "disability is an umbrella term for impairments in body functions and structures, limitations in activities and restrictions in participation" [12]. We controlled for disease course when analyzing the impact of disabilities on QoL. The clinical course of MS can vary from stable, to slowly progressive to rapidly progressive. It is known that disease course can influence QoL, meaning that, all other factors being equal, the more aggressive the disease course, the lower the QoL [13,14].

Methods

Samples

We applied a postal survey to two samples of patients with MS – members of the MS patients' association in the North of the Netherlands (PA sample) and patients from the Groningen MS center, part of the Neurology Department of the University Hospital (UH sample). Respondents could not participate in both samples. Of the 172 questionnaires sent out in the PA sample, 153 questionnaires (89% response rate) were returned and used for analyses. Of the 562 patients in the UH sample, 377 patients (67% response rate) completed the questionnaires. The non-responders in both samples did not differ in age and gender from participating patients.

Measures

Multiple Sclerosis Impact Profile (MSIP)

We applied the MSIP to assess MS-related disabilities [15,16]. The MSIP is a recently developed measure with established psychometric properties and is based on the International Classification of Functioning, Disability and Health [12]. The MSIP reflects an objectified view of the prevalence and severity of MS-related disabilities and consists of 36 items divided over seven scales and has four additional impairment items. Item scores are graded on three to five-point rating scales with discrete responses, ranging from 0 (no disability) to 3 or 4 (complete disability). Scores are summed for each scale. MSIP scores can vary from 0 to 12–24 for the scale variables, and from 0 to 4 for the single impairment items [15]. For reasons of comparability of the scores for each scale and single impairment items, in this study the summed and individual scores were multiplied to obtain a result ranging from 0 to 100.

The MSIP showed satisfactory levels of internal consistency. Cronbach's alphas ranged between 0.49 (environmental factors) and 0.91, whereas the mean inter-item correlations ranged between 0.19 (environmental factors) and 0.65. Test-retest reliability intraclass correlations ranged between 0.65 (environmental factors) and 0.97.

QoL measures

QoL was assessed using two generic health-related QoL measures, the SF-36 and the WHOQOL-BREF. SF-36 consists of eight scales and two separate questions covering physical, psychological, and social aspects of health [17]. Item scores were coded, summed, and transformed to a scale ranging from 0 (worst health) to 100 (best health) for each dimension. In a previous Dutch study of patients with MS [18], the SF-36 showed satisfactory levels of internal consistency. Cronbach's alphas ranged between 0.69 and 0.93, and test–retest reliability correlation coefficients ranged between 0.48 and 0.87. In our study, Cronbach's alphas ranged between 0.74 and 0.96.

The WHOQOL-BREF [19] was the second QoL measure applied in this study. The WHOQOL-BREF consists of 26 items divided into four domains covering physical, psychological, social, and environmental aspects and has two single-item questions. For each scale, item scores were coded, summed, and transformed to a scale ranging from 0 (worst health) to 20 (best health). In a previous Dutch study [20], the WHOQOL-BREF showed satisfactory levels of internal consistency. Cronbach's alphas ranged between 0.66 and 0.80. In our study, Cronbach's alphas ranged between 0.63 and 0.81.

Disease course

The various clinical courses of MS can usually be characterized either as episodic acute periods of worsening, or gradually progressive deterioration of neurological functioning, or as a combination of the two [21]. To assess the course of the disease, respondents were asked to choose a description for the course of MS that best suited their case out of five briefly described recognizable disease courses. These descriptions were used to identify whether

patients had experienced a stable (with or without relapses), slowly progressive (with or without relapses), or rapidly progressive disease course over the preceding 6 months [13,22]. Because the disease course subgroups are based on self-reports, they are similar but not equal to distinctions in disease course made by neurologists.

Procedures

Respondents in both samples completed the MSIP [15], the WHOQOL-BREF [19], and demographic and disease course questions. In addition, PA sample respondents also completed the SF-36 [17].

The local University Hospital Medical Ethics Committee approved the research proposals for both studies. Written informed consent from respondents from both samples was obtained.

Analysis

Analysis of variance (ANOVA) for multiple comparisons with post-hoc Bonferroni correction was used to determine statistically significant differences between the disease course subgroups for the continuous variables. For the categorical variables, the *k*-independent samples test was applied with post-hoc analysis for Mann–Whitney *U*-tests.

Next, the impact of the MS-related disabilities on QoL was assessed using a series of hierarchical regression analyses with each of the QoL scale variables as dependent variables. On the basis of statistically significant correlations of the most important background variables (age, gender, marital status, and educational level) with the QoL dependent variables, age was included as the covariate for five QoL variables and educational level as the covariate for two QoL variables. Before entering variables into the analysis, dummy variables were generated for the categorical variables (disease course and educational level) and for the four single impairment items (fatigue, pain, impairment in speech functions, and impairment in sight functions). Background and disease course variables were then entered in the regression model at the first step and the MSIP-disability variables (all in one) at the second step to determine whether they explained a significant percentage of the variance in QoL. The expected direction of standardized β-weights is negative, meaning that less disability equated to better QoL.

Results

Samples

The characteristics of the PA and UH samples were similar. More detailed information on the comparison of the PA and UH was reported earlier [15]. The results for the whole sample are presented in Table 1. The characteristics of the disease course sub-samples were similar for most characteristics but differed for employment status and age. As

Table 1 Characteristics of total sample and for sub-samples for course of MS

Variable	Total sample	Stable	Slowly progressive	Rapidly progressive	*P* value
N (%)	530 (100)	235 (43)	243 (44)	26 (5)	
Gender[a]					
Female (%)	375 (71)	174 (74)	168 (69)	16 (62)	0.273
Male (%)	155 (29)	61 (26)	75 (31)	10 (39)	
Age[b]					
Mean (SD)	50 (11)	47 (11)	53 (10)	51 (11)	0.000
Range	23–85	23–80	27–85	29 (72)	
Marital status (%)[a]					
Married/partnership	414 (80)	182 (78)	201 (83)	21 (81)	0.300
Unmarried/widowed/divorced	106 (20)	52 (22)	40 (17)	5 (19)	
Educational level (highest level) (%)[a]					
Primary or secondary school/vocational training	362 (70)	157 (68)	169 (70)	19 (73)	0.740
Higher professional education/university	157 (30)	75 (32)	71 (30)	7 (27)	
Employment status (%) (more answers possible)[a]					
Following a training or study program	19 (4)	13 (6)	5 (2)	—	0.074
Full-time employment	45 (9)	34 (15)	9 (4)	1 (4)	0.000
Part-time employment	67 (13)	39 (17)	22 (9)	2 (8)	0.033
Part-time retired because of MS	65 (12)	36 (15)	22 (9)	4 (15)	0.101
Full-time retired because of MS	260 (50)	86 (37)	148 (61)	16 (62)	0.000
Housewife/househusband	164 (31)	74 (32)	77 (32)	7 (27)	0.882
Retired because of age	42 (8)	11 (5)	28 (12)	2 (8)	0.024
Years since MS Diagnosis[b]					
Mean (SD)	13 (8)	12 (8)	13 (8)	11 (6)	0.098
Range	1–53	1–53	1–36	2–32	

[a]ANOVA analysis and [b]Chi-square analysis for comparison of disease course sub-samples.

Table 2 Prevalence and severity[a] of disabilities in the whole sample and in the disease course sub-samples

MSIP	Total sample $N = 504$		Stable $N = 235$		Slowly progressive $N = 243$		Rapidly progressive $N = 26$		Group differences
	%	Mean (SD)	%	Mean (SD)	%	Mean (SD)	%	Mean (SD)	F or H[b]/P[c]
Impairments in …									
Muscle and movement functions	86.7	30.9 (21.5)	74.1	20.2 (18.6)	97.4	39.3 (19.0)	100	50.5 (19.3)	71.6/0.000
Excretion and reproductive functions	84.8	30.4 (24.7)	73.3	19.9 (20.2)	94.3	39.0 (24.6)	95.7	44.9 (25.6)	38.9/0.000
Mental functions	82.6	21.7 (16.7)	73.6	15.1 (13.6)	88.5	26.4 (17.3)	100	31.7 (4.2)	28.7/0.000
Limitations in …									
Basic movement activities	78.7	32.4 (30.8)	62.8	17.1 (22.9)	92.5	44.3 (30.4)	96.2	59.7 (30.4)	72.8/0.000
Activities of daily living	81.7	36.1 (31.6)	66.7	20.3 (23.5)	94.2	48.9 (31.2)	100	59.5 (31.8)	72.3/0.000
Restrictions in …									
Participation in life situations	65.5	20.7 (24.9)	48.1	9.7 (15.7)	79.3	29.6 (27.5)	84.0	36.2 (26.8)	48.5/0.000
Lack of support from …									
Environmental factors	62.4	22.1 (23.0)	58.4	21.3 (23.4)	64.1	22.3 (22.8)	80.0	26.3 (22.4)	0.5/0.587
Impairments									
Fatigue	94.7	49.0 (24.7)	90.5	38.2 (20.8)	97.9	56.7 (23.9)	100	72.0 (22.0)	87.9/0.000
Pain	61.6	24.5 (24.1)	48.7	16.3 (19.6)	73.7	31.7 (25.6)	80.0	31.0 (23.1)	49.0/0.000
Impairments in speech functions	25.6	7.7 (14.2)	14.2	3.8 (9.8)	36.6	10.5 (15.4)	50.0	17.3 (23.2)	39.1/0.000
Impairments in seeing functions	55.5	21.5 (23.9)	45.8	14.4 (18.4)	66.1	26.3 (25.6)	76.9	38.5 (29.4)	38.9/0.000

[a]Severity or (mean) disability score: Score 0 = no disability; Score 100 = complete disability.
[b]F-statistic for ANOVA MSIP scales or H-statistic for Kruskal–Wallis test on MSIP single item impairments.
[c]*P* value for test of significance on group differences (for ANOVA $P < 0.05$; for Kruskal–Wallis test $P < 0.05/3 = 0.0167$).

expected, a larger proportion of respondents in the stable group participated in employment when compared with both samples with progressive MS. Consequently, a larger proportion of respondents with progressive disease course had retired because of MS than respondents with stable MS. People with stable MS were slightly younger than people with progressive disease course.

Prevalence and severity of disabilities

The prevalence and mean severity scores for the MS-related disabilities are shown in Table 2. "Fatigue" was reported as the most severe disability and was also the most prevalent. "Limitations in activities of daily living" was the second most severe disability followed by "limitations in basic movement activities", "impairments in muscle and movement functions" and "impairments in excretion and reproductive functions".

As expected, disabilities differed statistically significantly between the disease course subgroups, except for lack of support in environmental factors. Disabilities in patients with rapidly progressive MS were more severe compared with the disabilities in patients with slowly progressive MS, which in turn were more severe than the disabilities in patients with stable MS. Of note, post-hoc analyses were significant for all comparisons between the stable and progressive subgroups. However, only 4 of 11 comparisons between the slowly progressive and rapidly progressive subgroups were significant, meaning that the severity of disabilities were at about the same level in both progressive subgroups except for impairments in muscle and movement functions, basic movement functions, fatigue, and impairments in seeing functions.

Impact of disabilities on the SF-36 variables

Table 3 presents the results of the regression analysis designed to explain the relative role of each disability in the prediction of health-related QoL evaluated by the eight SF-36 variables. The disability variables contributed statistically relevantly to a unique segment of the variance for all SF-36 domains, especially social functioning, mental health, and bodily pain.

Most standardized β-weights were in the expected direction and showed that "impairments in mental functions" was a significant predictor for five of eight SF-36 domains, meaning that patients who reported less impairment in mental functions (cognitive, emotional, and sleep functions) reported better QoL in the domains of mental health, emotional functioning, social functioning, bodily pain, and vitality. "Limitation in activities of daily living"

Table 3 Hierarchical multiple regression of MSIP dimensions and impairment items on the SF-36 scales

MSIP	SF-36							
	Physical functioning β	Role physical β	Bodily pain β	General health β	Vitality β	Social functioning β	Role emotional β	Mental health β
Impairments in …								
Muscle and movement functions	–0.18	–0.18	–0.17	0.22	–0.21	–0.09	–0.12	–0.13
Excretion and reproductive functions	–0.05	0.02	–0.02	–0.24	0.03	0.26	0.31	0.15
Mental functions	0.06	–0.22	**–0.37***	–0.18	**–0.34***	**–0.43****	**–0.50***	**–0.57****
Limitations in …								
Basic movement activities	–0.13	0.32	0.26	–0.20	0.25	**0.32***** (**–0.33****)	0.21	**0.54*** (–0.09)
Activities of daily living	**–0.37*****	–0.24	–0.31	0.28	0.06	**–0.67****	–0.29	**–0.40*****
Restrictions in …								
Participation in life situations	–0.12	–0.14	0.04	–0.01	–0.19	–0.23	–0.27	–0.23
Lack of support from …								
Environmental factors	–0.03	0.08	0.11	–0.05	–0.06	0.07	0.08	–0.11
Impairments								
Fatigue	**0.18***** (0.13)	–0.14	–0.10	–0.05	–0.14	–0.06	0.02	–0.06
Pain	0.06	**–0.25*****	**–0.47****	–0.18	0.04	–0.15	–0.06	–0.11
Impairment in speech functions	0.04	0.03	0.04	–0.06	–0.07	–0.07	0.11	–0.03
Impairment in seeing functions	0.04	–0.00	–0.05	–0.24	–0.11	0.02	0.10	–0.05
Adjusted R^2	0.69	0.42	0.59	0.38	0.52	0.64	0.33	0.52
R^2 change	**0.36**	**0.20**	**0.54**	**0.25**	**0.19**	**0.52**	**0.23**	**0.46**
F	11.79**	4.59**	8.90**	4.32**	6.91**	10.62**	3.71**	6.97**
F change	7.14**	2.18***	8.52**	2.64*	2.62*	9.40**	2.26***	6.29**

MSIP, Multiple Sclerosis Impact Profile.
In bold: statistically significant β values and R^2 change values. Between brackets: β-value as a single explaining variable.
*$P < 0.01$; **$P < 0.001$; ***$P < 0.05$.

was an important predictor in social functioning, mental health, and the physical function domains of QoL, meaning that patients who were less limited reported better QoL. "Limitation in basic movement activities" was a significant predictor in the QoL domains for mental health and social functioning. However, on the contrary to expectations, betas were positive here, meaning that patients who were more limited in these activities (such as maintaining or changing the body position, transferring oneself, or in the use of hand and arm) reported better QoL. "Pain" was a significant predictor for the physical functioning and bodily pain QoL domains, with a beta in the expected direction. Finally, "fatigue" was a statistically significant predictor of physical functioning, but showed a positive beta, meaning that a patient with more severe fatigue complaints reported better QoL for this domain.

Impact of disabilities on the WHOQOL-BREF variables

The results of the regression analysis to determine the effect of the various disabilities on health-related QoL, evaluated by the four WHOQOL-BREF domains, are presented in Table 4. The disability variables contributed to a unique segment of the variance for all four QoL domains. The standardized β-weights were in the expected direction and showed that "impairments in mental functions" was a significant predictor in all QoL domains and even the most significant predictor in physical health and psychological health, meaning that patients who reported less impairment in mental functions reported a better QoL. The second most important predictor for three of four QoL variables was "lack of support from environmental factors", meaning that patients who reported less lack of support from immediate family, personal assistance or the social security and health services reported better QoL in the psychological health, social relationships, and environment domains. "Restrictions in participation in life situations" was the strongest predictor in the environment QoL domain and the second strongest predictor of psychological health, meaning that patients with fewer restrictions in participation reported better QoL. "Impairments in excretion and reproductive functions" was the most causative predictor for the social relationships QoL domain. Patients who reported more impairment in excretion and reproductive functions reported a poorer QoL. Furthermore, "limitations in activities of daily living" and "pain" were statistically significant predictors of QoL for physical health.

Discussion

In this study we examined the relative impact of various MS-related disabilities on health-related QoL. Our findings show that "impairment in mental functions" was the most important predictor of health-related QoL. Fatigue was the most severe impairment with the highest prevalence in all

Table 4 Hierarchical multiple regression of MSIP dimensions and impairment items on the WHOQOL-BREF scales

MSIP	WHOQOL-BREF			
	Physical health β	Psychological health β	Social relationships β	Environment β
Impairments in …				
Muscle and movement functions	**–0.17***	0.06	0.16	0.09
Excretion and reproductive functions	0.11	–0.07	**–0.37****	0.10
Mental functions	**–0.38****	**–0.42****	**–0.18***	**–0.23***
Limitations in …				
Basic movement activities	–0.02	0.00	–0.11	–0.13
Activities of daily living	**–0.27***	–0.00	0.07	–0.03
Restrictions in …				
Participation in life situations	–0.13	**–0.21*****	–0.09	**–0.28*****
Lack of support from …				
Environmental factors	–0.06	**–0.17*****	**–0.23****	**–0.31****
Impairments				
Fatigue	–0.05	0.05	0.06	0.02
Pain	**–0.15***	0.04	–0.02	–0.03
Impairment in speech functions	0.03	0.00	0.05	0.10
Impairment in seeing functions	0.04	0.01	–0.03	–0.02
Adjusted R^2	0.60	0.41	0.25	0.35
R^2 change	**0.39**	**0.29**	**0.23**	**0.27**
F	23.94**	13.51**	6.41**	9.16**
F change	20.14**	10.49**	6.28**	8.74**

In bold: statistically significant β values and R^2 change values.
*$P < 0.05$; **$P < 0.001$; ***$P < 0.01$.

disease course subgroups, whereas the impact on QoL was not statistically significant in any of the QoL domains, except for physical functioning evaluated using the SF-36.

The results of regression analysis showed that the contribution of disabilities differed for the comparable domains in both QoL measures (i.e., mental health in SF-36 and psychological health in WHOQOL-BREF) indicating that both measures operationalized these dimensions differently. In general, QoL using the SF-36 was sensitive to the MSIP "impairments in body functions" and the "limitations in activities" disability variables, whereas QoL measured by the WHOQOL-BREF was also sensitive to the "restrictions in participation" and "lack of support of environmental factors" variables. These differences between the QoL measures can be explained by the background of both measures – the SF-36 originated in the early days of QoL measurement development in which the focus was on physical functioning, whereas the WHOQOL-BREF is a more recently developed measure based on a broader and more balanced definition of QoL, which includes participation in life situations and the influence of the environment.

Our findings of a very high prevalence and severity for fatigue confirmed findings in earlier studies [23]. However, on the contrary to earlier findings, fatigue in our study showed a limited impact on QoL compared with other studies examining the impact of fatigue on QoL [5,6]. An explanation may be that the effect of fatigue on QoL is mediated by the effect of other MS-related impairments on QoL. Previous studies of the effect of single impairments on QoL were unable to adjust for this mediating effect.

Impairments in mental functions, including impairments in cognitive, emotional, and sleep functions, were reported by more than 80% of the respondents in the total sample. Therefore, their prevalence is far higher than findings in earlier studies performed on cognitive impairments (40–65%) [24,25] and depression (lifetime prevalence of 50% and annual prevalence of 20%) [26]. A possible explanation could be the combination of both aspects into one variable "mental functioning". Earlier findings that cognitive impairments have a major impact on all aspects of QoL [24,25] were confirmed in our study. The same holds true for the impact of depression on QoL [4,5,8,9]. The high prevalence of impairments in excretion and reproductive functions found in earlier studies [27] was confirmed in this study. Bowel and bladder dysfunctions were related to a reduced quality of social functioning [11,28]. This is confirmed by our findings – when QoL is evaluated using the WHOQOL-BREF. Sexual disturbance was associated with a reduced quality of mental health [11,29], which could not be confirmed by our findings – "excretion and reproductive functions" was the most important explanatory aspect of QoL concerning social relationships (WHOQOL-BREF), but showed no statistically significant contribution to mental health (SF-36) or psychological health (WHOQOL-BREF). The prevalence of pain in our sample matched results in earlier studies [10,30]. These studies also reported that pain is particularly correlated with the mental health and physical functioning aspects of QoL. In our study, pain was the most causative variable in QoL related to physical functioning (SF-36), physical health (WHOQOL-BREF), and bodily pain (SF-36), but showed no significant contribution to mental health (SF-36) or psychological health (WHOQOL-BREF).

We found some statistically significantly positive betas (i.e., more disability = better QoL) for the MSIP "limitations in basic movement activities" in the SF-36 social functioning and mental health variables, and for "fatigue" in the SF-36 physical functioning variable, where a negative beta was expected. A possible explanation could be the inter-item correlation between the MSIP variables. As we entered the MSIP variables at the same time (all in one) in the regression model (multivariate analysis), these correlations could explain the positive betas as a case of confounding correlations between the MSIP variables, meaning that effects of the separate disabilities can be influenced by the effects of other MS-related disabilities. We, therefore, applied the MSIP variables with a positive beta as a single explaining variable in the regression model (univariate analysis). The direction in two of the three betas thereby reversed to statistically not significant values, and the direction of the third beta (the limitations in basic movement activities for the social functioning variable) changed to the expected negative direction (see figures between brackets in Table 3). Another explanation for these unexpected results can be the finding that the impact on QoL appeared to be dependent on the applied QoL measure. The WHOQOL-BREF was sensitive to disabilities related to all four ICF components, whereas the SF-36 was only sensitive to disabilities in the body functions and activities components and not for disabilities in the participation and environmental factors components. Interestingly, we only found positive betas using the SF-36 as the outcome. Apparently, the WHOQOL-BREF is better able to measure the effect of each disability separately.

Methodological considerations

We succeeded in obtaining data from a representative sample of people with MS as regards the number of respondents, demographic variables, and

disease-related variables (years from diagnosis and disease course). The unusually high response rate in the PA sample (89%) is probably because of the fact that these respondents were participating in another longitudinal study and we did not approach non-responders or dropouts. Therefore, we assume that at the time of our measurement, patients in the PA sample were highly motivated and willing to complete our questionnaires. Patient characteristics from both PA and UH samples were similar to what has already been published [15].

One issue that may limit the representativeness of our findings is that the number of patients (5%) who reported a rapidly progressive disease course was limited. Although it is known that a minority of patients (prevalence about 15%) have primary progressive MS [31], this sub-sample was probably less representative for patients with a primary progressive disease course.

Furthermore, there might have been some scaling bias or systematic bias because of the use of self-report questionnaires, but their effect on the final results is probably neutralized through the application of self-report questionnaires in the disability and the QoL evaluation.

Implications

This study generated new evidence on the relative impact of various disabilities on health-related QoL. As disabilities in mental functions turned out to have the largest impact on QoL and also showed a high prevalence among patients with MS (more than 80%), professionals should be aware of this finding. Further work is needed to explore whether interventions with the intention to try and improve cognitive functioning can improve QoL as well as cognitive functioning. Furthermore, treatment programs should give priority to interventions concerning impairments in emotional functioning and sleep, as both aspects are relevant aspects of mental functioning.

Their effects are best evaluated using the WHOQOL-BREF because this measure seems more sensitive to reflect the impact of disabilities on QoL.

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